ASTRONOMICAL SOCIETY OF LONDON.

June 12, 1829. No. 21.

The following communications were read, viz.:—

1. On the convertible pendulum; by Benjamin Gompertz, Esq., in a letter to Francis Baily, Esq.

The remarkable anomalies which offered themselves to Mr. Baily, in his researches upon the length of the seconds pendulum, induced him to propose the general problem to the consideration of Mr. Gompertz, some time before the presentation of Captain Everest's paper upon the same subject. It will be seen that these two gentlemen have treated the subject in very different ways, although arriving at the same conclusion; viz. that very serious errors may arise from a faulty placing of the knife-edges, and that the results to be obtained from the convertible pendulum are less certain than has been hitherto supposed, unless the knife-edges can be fixed with considerable accuracy in a given position, or the deviation from that position be capable of measurement.

The well-known theorem upon which Captain Kater has founded his beautiful method of investigating the length of the pendulum, viz. the reciprocity of the centres of suspension and oscillation, requires, as is seen from the demonstration, that the axes on which the pendulum vibrates should be parallel,—a condition not very readily obtained. When, however, these axes or knife-edges are parallel, and the oscillations isochronous, the resulting length of the pendulum (the corrections for arc, buoyancy, &c. being made,) is the sum of the perpendiculars let fall from the centre of gravity upon each of the knife-edges. This sum will equal the measured distance of the knife-edges when the following conditions are fulfilled:—1st, When the plane determined by the knife-edges passes through the centre of gravity; 2nd, When the measured line is perpendicular to the knife-edges.

If these conditions be not fulfilled, the result of the experiment will necessarily be erroneous; but if the nature and magnitude of the errors committed in placing the knife-edges can be ascertained, the corresponding error in the estimated length of the pendulum may be corrected by calculation.

Let it be supposed that the experiment has been performed,—that the axes are convertible,—the distance between the knife-edges measured, and the time of an oscillation determined after applying the corrections for arc, &c. Also let

λ = the true length of the equivalent simple pendulum;

h = the perpendicular from the centre of gravity upon the upper knife-edge;

k = ——————————————————— lower ——— ;

M = sum of each particle × distance from an axis through centre of gravity parallel to upper knife-edge × $\frac{1}{\text{Pendulous body}}$;

M′ or M − α = Ditto to lower knife-edge × $\frac{1}{\text{Pendulous body}}$;

l = the measured distance between the knife-edges; then

$$\lambda = h + \frac{M}{h} = k + \frac{M - \alpha}{k};$$

therefore, substituting in the second equation the value of M taken from the first,

$$\lambda = k + \frac{h\lambda - h^2 - \alpha}{k}, \text{ and } \lambda = \frac{h^2 - k^2 + \alpha}{h - k} = h + k + \frac{\alpha}{h - k}.$$

It will be easy to find the difference between $h + k$ and l, if the position of the knife-edges be given, as h and k are known approximately.

Let $h + k = l - n$; then $\lambda = l - n + \frac{\alpha}{h - k}$, where $h - k$ is also known with sufficient exactness.

Mr. Gompertz then shews how the small correction α, which he calls the dynamical correction, is to be obtained; but this portion of the paper does not admit of elementary explanation.

In a pendulum 60 inches long, 2 inches wide, and 1 inch thick, Mr. Gompertz shews that a mistake of $\frac{1}{96}$ of an inch in the length of the pendulum might arise from errors of 1° in fixing the knife-edges.

2. Original observations of a small comet at Paramatta, (longitude $10^h\ 4^m\ 7^s$ east of Greenwich) by Mr. Dunlop.

The comet was compared in R.A. and declination, with neighbouring stars, by means of a micrometer made by Mr. Dunlop. The journeyman employed was compared with a sidereal clock, whose rate and error were obtained by equal altitudes of the sun, taken with a sextant and artificial horizon. The error of the clock, the comparison with the journeyman, and the value of the revolutions and divisions of the micrometer, are all given; the stars of comparison are identified. This comet appears to be one of a short period.

Another comet was observed about the same time, but the complete observations are not at present in Mr. Dunlop's possession.

3. An extract of a letter to Mr. Herschel from Dr. Olbers, with the R.A. and declinations of Encke's comet, observed by him at Bremen.

Dr. Olbers could perceive no tail. He conceives this comet to have established two important points: — 1st. That it has no light of its own, but shines only by the reflection of that of the sun; 2nd. That it does actually suffer a resistance in that part of space in which it moves. The ephemeris of it, calculated by Encke on the hypothesis of such resistance, indicates only a small and nearly constant error, giving the R.A.'s about 2′ or 3′, and the declinations 1′, too small; while that of Damoiseau, who supposes no resistance,

gives a very variable error, which, after the middle of November, is very large.

4. Occultations and solar eclipses observed at Palermo, from 1794 to 1819, communicated by Colonel Visconti.

The observations are chiefly made by Piazzi and Cacciatore, and are given in Palermo mean time. The political disturbances of 1820 deranged the observatory so entirely that the solar eclipse of September 7 (which was annular at Palermo) could not be observed, and no observations were made there for some time afterwards.

5. Occultation of Jupiter at Port Famine, Straits of Magellan, in a letter from Capt. King, R.N. to Charles Stokes, Esq.

Lat. 53° 38′ 20,7″ South. Approx. Long. 70° 56′ 4″ West.

May 26, 1828.	Time by Chronometer. h.	m.	s.
Disappearance of 3rd satellite behind ☾'s dark limb	16	21	10,5
Disappearance of 2nd ———	16	26	28,2
♃'s western limb in contact	16	31	19,2
Disappearance of 1st satellite	16	37	52,3
When ♃ appeared to be the most eclipsed, a very minute portion was visible between two elevations at the moon's "new" disc	16	42	26,0
Re-appearance of the 2nd satellite much beyond the disc	16	45	25,0
♃'s eastern limb in contact with ☾'s disc	16	51	51,0

The disappearance and re-appearance of the 4th satellite, and the re-appearance of the 1st and 3rd, were obscured by mist.

The observations were made on shore with a two feet reflecting telescope, by Thomas Jones, using the highest power of the eye-tube, and largest of the small specula.

The chronometer was $6^h\ 9^m\ 53^s,1$ fast on apparent time.

6. A letter from Professor Bessel to Capt. Smyth, Foreign Secretary.

After acknowledging the receipt of the Society's gold medal, presented at the last anniversary, Professor Bessel says: "I may mention that the zones are at present brought to their 467th number, and that by far the greatest part of the heavens, from 15° to 45° north declination, is filled up. I should have made still further progress but for the unfavourable weather last winter. I was in hopes of extending these observations, in the course of the present year, over the remaining parts between 15° and 45°; but now a year more will be requisite. As soon as I have completed my present task, I shall have the honour of communicating it to the Astronomical Society. The Celestial Charts, which are intimately connected with these observations, are advancing; five hours are nearly or wholly ready for publication."

7. The remainder of a paper by Mr. Sheepshanks, upon the application of Da Rocha's method of interpolation.

The publication of this paper is postponed, as the author has not had time to complete some calculations which should accompany it.

J. MOYES, TOOK'S COURT, CHANCERY LANE.